THE IMPACT OF PETER RAVEN ON EVOLUTIONARY AND BIODIVERSITY ISSUES IN THE 20TH AND 21ST CENTURIES: INTRODUCTION[1, 2]

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The 53rd Annual Systematics Symposium of the Missouri Botanical Garden, held on 13–14 October 2006, had as its theme "The Impact of Peter Raven on Evolutionary and Biodiversity Issues in the 20th and 21st Centuries." This focus on the work and impact of one individual, a departure from previous Garden symposia based on single topics, was occasioned by the celebration in 2006 of the 35th anniversary of Peter Raven's arrival as Director of the Missouri Botanical Garden. Given that two thirds of the Garden's annual symposia have taken place during his tenure, this seemed a particularly appropriate opportunity to celebrate Peter Raven's intellectual contributions to the broader scientific community and, indeed, to the world at large.

A committee of Raven's colleagues (Olga Martha Montiel, Barbara Schaal) and former students (Paul Berry, Peter Hoch, and Warren L. Wagner) convened to decide what issues to cover and who would speak. The selection process was difficult, given the breadth of Raven's intellectual contributions and the constraint of only eight speaking slots. Faced with his massive publication record (more than 650 entries at the end of 2005), the committee chose topics to which Raven made major contributions that continue to be important areas of research, hence the selection of population biology/gene flow, biogeography, coevolution, pollination biology, and cytogenetics. Other areas to which Raven has made immense contributions are less easily characterized, but we determined that the broad area of conservation/biodiversity certainly should be included. Finally, in thinking not only about the exceptional intellectual leadership he has provided to the Garden for 35 years, to his own students, and to legions of other students influenced by his three top-selling college textbooks, but also about the many institutions he has served with distinction—the National Academy of Sciences, the National Geographic Society, the National Science Board, among others, the universities at which he has held positions, and the many scientific societies to which he belongs or has been elected—we decided we needed a talk that would address Raven's contributions to "building capacity" in the broadest sense. Fortunately, to round out the final slate of eight talks, Paul Ehrlich agreed to give the evening address, which provided a more personal perspective on the very fruitful collaboration he shared with Raven over the course of more than 40 years.

Due to various extenuating circumstances, not least the unique historical perspective adopted by most of the speakers, only two manuscripts resulted from this symposium, those by Diane Campbell (pollination biology) and J. Chris Pires and Kate L. Hertweck (cytogenetics), which follow this introduction. What follows here is a brief synopsis of the remaining talks, in the order of their presentation at the symposium.

Barbara Schaal (Washington University) presented "Differentiation of Populations: Gene Flow Redux," revisiting the seminal paper published in *Science* in 1969 (Ehrlich & Raven, 1969), "Differentiation of Populations." This paper challenged the prevailing orthodoxy that species were evolutionary units held together by gene flow, and opened a broad and productive field of research into the empirical

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[1] This and the two articles that follow it are the proceedings of the 53rd Annual Systematics Symposium of the Missouri Botanical Garden, "The Impact of Peter Raven on Evolutionary and Biodiversity Issues in the 20th and 21st Centuries." The symposium was held 13–14 October 2006, at the Missouri Botanical Garden in St. Louis, Missouri, U.S.A.

[2] This was the 51st Missouri Botanical Garden Annual Systematics Symposium to be supported by a grant from the National Science Foundation (grant DEB-0515933). The meeting was organized by Barbara Schaal of Washington University and Peter Hoch of the Missouri Botanical Garden, with the assistance of Paul Berry (then at University of Wisconsin) and Warren Wagner (Smithsonian Institution). P. Mick Richardson was responsible for the smooth running of the symposium, with the welcome and able assistance of Mary McNamara, Sandy Lopez, Donna Rodgers, William Guy, and Zubin Chandran. Victoria C. Hollowell, Beth Parada, and Allison Brock (Missouri Botanical Garden Press) were responsible for the publication of the symposium proceedings. This symposium, together with 36 previous ones, again benefited considerably from the contributions, support, and encouragement of Peter Raven.

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measure of gene flow, which remains active and vibrant to the present. Through the use of several model plant systems, Schaal explored the processes that enhance and retard population differentiation.

Stephen J. O'Brien (Laboratory of Genomic Diversity, National Cancer Institute) presented "Genomic Archaeology—Solving the Mysteries of History," which explored the topic of diversity from the perspective of comparative genomics in mammals, and reported recent advances in conservation genetics. Using examples from his remarkable genomic research on such diverse mammals as cats and elephants (O'Brien, 2003), O'Brien discussed new approaches to the elucidation of biological diversity, with applications for sampling methods and the analysis of extinction, in these topics echoing many publications by Raven (e.g., Phillips & Raven, 1997; Raven & McNeely, 1998).

Ulrich Mueller (University of Texas at Austin) presented "Coevolutionary Principles of Insect Fungiculture: Lessons for Human Agriculture?," which demonstrated the rich intellectual fruit borne from the original planting of the idea of coevolution by Ehrlich and Raven (1964) in their article in *Evolution*, "Butterflies and Plants: A Study in Coevolution." Using the remarkable adaptations found in fungiculturist attine ants (Gerardo et al., 2006), Mueller demonstrated the sophistication of recent coevolutionary analyses and presented the ant-fungus-microbe interactions as an intriguing analogy to human agriculture, with important potential applications for improving the latter.

Jun Wen (National Museum of Natural History, Smithsonian Institution) presented "Evolution of Major Patterns of Plant Disjunctions," reviewing and updating many of the hypotheses proposed by Raven over many years (e.g., Raven, 1963), most notably in his collaborative work with the late Daniel Axelrod (e.g., Raven & Axelrod, 1974, 1978). Wen enumerated the major intercontinental disjunction patterns, with many examples from recent work, noting the insights gained from modern phylogenetic analyses and the nascent field of lineage dating based on fossil and molecular data.

Cristián Samper (National Museum of Natural History, Smithsonian Institution) presented "A Raven's Garden: Building Capacity for Plant Research and Conservation," in which he discussed the need for building capacity in all countries and how that relates to the rapid destruction of biological diversity worldwide. He then explored some of the impacts that Peter Raven has had in this area, developing flora projects in many biodiverse regions, placing staff in the countries of origin, developing tools to enhance the flow of information about species, and developing long-term partnerships for conservation.

Paul Ehrlich (Stanford University) closed the Symposium with his evening address, "Saving the World," an informal and humorous recollection of his long and fruitful collaboration with Raven, and how some of those ideas have developed into new fields of study. With a playful allusion to the title of one of Raven's (1988: "We're Killing Our World") singular contributions on conservation and the human impact on the global ecosystem, Ehrlich shared his deep passion for the study of biology and the need for personal responsibility in conservation (Ehrlich, 2000), and his personal insights and humor regarding his relationship with Peter Raven made for a fitting close to a day of celebration.

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